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ABSTRACT

Seychelles Integrated Science (SIS), a 3-year laboratory-based science program for students (ages 11-15) in upper primary grades 7, 8, and 9, was developed from an extensive evaluation and modification of previous P7-P9 materials. This P9 SIS unit deals with: (1) the importance of energy in students' everyday lives; (2) energy forms and conversions; (3) benefits and costs of electrical energy; (4) alternative energy sources which may be used in Seychelles; and (5) the need to conserve renewable and non-renewable sources of energy. Provided for the unit is a student workbook and a set of teaching notes. The teaching notes include an overview of the SIS program, the general aims of the unit, and a lesson plan for each topic area. Each lesson plan includes a suggested time frame, a list of objectives, a list of equipment needed, and a suggested lesson format. This format includes suggestions for introducing the lesson, instructional strategies (emphasizing procedures for student activities), and evaluation methods. The student workbook includes procedures for completing the unit activities and a list of new words keyed to page numbers in the workbook. (JN)

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seychelles integrated science

Unit 11

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TEACHING NOTES

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Seychelles Integrated Science

Introduction

Seychelles Integrated Science (SIS) is a three-year laboratory based science programme for pupils in P 7, P8 and P9 classes. It assumes that the pupils will have six, forty-minute periods of science each week, at least four of which will be in a laboratory. The programme aims to develop in the pupils;

1 The ability and willingness to look at and observe their surroundings and events in their surroundings objectively.

2 The ability and willingness to use a logical and rational "scientific" approach to everyday life based on objective observation.

3 A knowledge and understanding of scientific and natural phenomena and an ability to communicate with others about these.

4 An ability and willingness to use and relate scientific knowledge and skills to everyday life.

5 An awareness of the influence that science and technology have both on their everyday life and on the lives of other people, plants and animals.

If these five aims are achieved by the pupils then it is expected that they will be able to observe and record information about their surroundings and events in their surroundings using a systematic and controlled approach. They will be able to interpret and evaluate both qualitative and quantitative information so that they can reach a conclusion and substaniate it. They will be able to relate the scientific knowledge and vocabulary, appropriate to a fourteen year old, to the problems they encounter in their everyday life and they will be able to read and interpret relevant information so that they can reach informed decisions regarding the use and application of science and technology in their environment.

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To help achieve these aims SIS uses student texts, teacher's handbooks and a variety of audio visual materials. For 1984 it is hoped also to produce a series of pupils' background reading materials.

There are sixteen student units or booklets and a set of teaching notes for each unit. If you do not receive either the unit or the teaching notes please ask your school administrator to contact the Science Section of NIP. The student materials are produced in booklet form and we no longer use the worksheet format. So please do not let your pupils write on the booklets - you may need them again next year. Student's observations and records of experiments should be kept in a science notebook - or as we would prefer to call it a science workbook. The booklets are sequenced in nature so as far as possible go through the programme following the sequence of the units.

Units 1 to 5 in P 7,
Units 6 to 11 in P 8, and
Units 12 to 16 in P 9.

The units are intended for all classes within each form. There are some activities within each unit, however, which may only suit faster working or more able pupils.

Teaching notes are supplied for each unit and in these we set out the general aims of the unit and the objectives of the individual topics and lessons. We also list the equipment you will need for the lessons and give some idea of the time required to teach each topic. A <u>suggested</u> lesson plan is described for every lesson. You do not have to follow these lesson plans. They are sent only to help. We do ask, however, that you ensure that the pupils achieve the objectives set for each topic. You may wish to adapt the plan to better suit your school or locality, please do so but do make sure that at the end of the topic the pupils have achieved the stated objectives. The objectives are the most important guideline for the whole programme. Future examinations and evaluations will test the pupils' achievement of the objectives.

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In addition to the pupil's texts and teacher's notes there will also be some video tapes, 35 mm slides and cassette tapes linked to a number of the units. Where these are needed they will be referred to in the teaching notes. Please check through each set of notes as soon as you receive them to help you to order the audio visual materials and to borrow equipment from the Science Centre. If there are items of equipment that you need and they are not available in your school you should be able to borrow them from the Science Centre via your technician. Audio visual materials will either be sent out as part of your school resources or you can borrow them from the Television Liason Officer at NIP (Ext 162).

The new programme being introduced in 1983 has been developed following an extensive evaluation and modification of the previous P7 - P9 materials. The evaluation and modification has been carried out by the Science Section of NIP with the cooperation of the Inspectorate, Tutors at the TTC, the National Youth Service and teachers in P7 to P9 classes. The new materials aim to make the programme more relevant and meaningful to pupils. They are also designed to make lesson preparation easier and less time consuming for the teacher. Please study the aims of the programme carefully. You will see that in the programme we stress the importance of teaching children to USE the knowledge and skills that they acquire in science. We hope that not only will they be ABLE to use them but, just as important, they will WANT to use the scientific knowledge and skills they learn in school in their everyday lives at home and at work.

We ask you, the teachers, to please ensure that as often as possible, it is the pupils who carry out the practical work, it is the pupils who discuss and talk about what they see and do and it is the pupils who use their own words to write about their work.

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For some topics you may wish to carry out a demonstration experiment - but please make sure that for every double period lesson there is at least one activity that the pupils carry out. Avoid giving the pupils notes to copy down. When notes are needed , for example, when recording what happened in an experiment or describing the function of an organ, get the pupils to explain or describe what they observed or did, and then let them write their own notes. With some slower working classes you may need to help the pupils by writing out their verbal explanation on the board. As the pupils learn more about writing notes you will need only write the 'key' words of explanation and allow the pupils to use these as their guidelines.

Try to encourage the children to think about what they are doing. Avoid using questions to which they can give 'yes' or 'no' answers. Questions such as " Is this right ?" How many times ?" "Can you see what happens ?" Instead ask questions which require the pupils to think about their answers and to give an answer of a sentance or more. "What happened when you did that ?" "Why do you think it happened ?" "What did you see ?" "What would happen if .....?" "Tell me how you would .....?"

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The P 7 - P 9 programme can only achieve its aims if science teachers frequently allow the pupils to

1. carry out practical work themselves,
2. think about and discuss what they observe and do, and
3. write about what they observe, learn and do, using their own words.

If teachers fail to do this, the pupils will become bored and indifferent and may come to reject science both in school and in everyday life. If the children enjoy and understand school science then there is every chance that they will understand and appreciate its use in their everyday lives and in their society.

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THE GOALS OF UNIT 11

Throughout P9 we are concentrating on energy and conservation. Unit 11 is the first in the P9 programme and here we introduce the pupils to some basic concepts about energy - wherever possible we relate these concepts to their use in the pupils' own environment.

Electrical energy is the form of energy much commonly used in Seychelles, so quite a substanial part of the unit is devoted to it. We emphasize the need for care and safety in using electrical energy.

Overall the unit has 5 main goals:

(1) To make the pupils aware of the importance of energy in our everyday lives.

(2) To make the pupils aware that energy can exist in different forms, can be changed from one form to another and can be stored in various ways.

(3) To develop in the pupils an understanding and appreciation of the benefits, dangers and costs of electrical energy.

(4) To make the pupils aware of alternative sources of energy which may be used in Seychelles.

(5) To develop an appreciation of the need to conserve renewable and non-renewable sources of energy.

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Lesson Plan

Unit 11 — Topic 1

About Energy

Time

We suggest that Topic 1 should take 2 to 3 periods. All pupils should carry out activities 1.0 to 1.6. Only the more able pupils may have time to carry out activity 1.7.

Objectives

At the end of the Topic the pupils should know that;

(1) in order to make an object move we must give it energy.

(2) the more energy a ball has when falling the higher it will bounce.

(3) the more energy we put into a pellet, with a rubber band, the further it will travel.

(4) more able pupils should be able to plot and interpret a graph relating the distance travelled by a pellet against the extension of a rubber band.

Equipment

Each group of 4 to 5 pupils will need a small ball, a rubber band, a metre rule and a small piece of paper to fold into a pellet.

Suggested Lesson Format

Introduction

Take one of the rubber balls and without making any comment to the pupils bounce it up and down of the floor for a moment or two. Now throw the ball from one hand to another and then repeat this using two balls. Ask the class if anyone can juggle with three balls. Allow one or two pupils to try this out. When you have the pupils interest, ask can anyone drop a ball so that it will bounce up to his/her head. Allow one or two pupils to try. Make sure they drop the ball rather than throw it down.

Activity

Tell the class that you want them to work in groups to see how high up a ball will "bounce back" if you drop it from a height of 1 metre. Get each group to carry out activity 1.1, three times.

Ask pupils in each group to describe to you what happens. From their descriptions select a sentence or two of their own words and tell them to write it down in their books. (If need be spellsome of the words on the board).

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Bring the pupils outside to carry out activities 1.2 and 1.3. As they do so you and the technician should move from group to group asking them to explain what they are doing and what they have observed.

When all groups have finished these activities discuss with the class what they have learned. In the discussion encourage the idea that the ball has to have energy in order to move.

- To help the pupils realize this leave the ball sitting on a bench top and ask the pupils "How can I set it to move?"

Allow the pupil to describe how they made the ball bounce higher. Try to help them achieve the objective (II for the lesson by encouraging them to say that to make the ball bounce higher you have to put more energy into it.

Now ask the class to read sections 1.4, 1.5 and 1.6 in their books. After they have read them. Ask one or two pupils to describe and demonstrate to the class what they are going to do Ask the rest of the class to judge if they are correct. When you are satisfied the class understand what to do allow them to carry out the activity.

With more able class you should carry out activity 1.7. Take the class outside. Ask them to estimate what distance in metres they think they can shoot the pellet. Get each group to "call out" its estimate, then allow a representative for the group to "Fire a shot" and then measure how far it travelled.

Bring the class back to the classroom. Tell them that a boy carried out an experiment with a rubber band to measure how the distance changed with how far he pulled back the rubber. Write the results on the board and ask them to plot a graph of these results. By plotting the "Pull back" or "Extension" of the rubber of the X axis and Y axis. (You may need to outline how to do this on the board).

Evaluation and Discussion

Immediately after the classes have carried out activity 1.4 - 1.6. Discuss with them what happened. Try to avoid "questioning" the pupils but rather try to encourage them to describe what happened and why they think it happened.

Use the pupils own words to write down a number of key words or ideas on the board and then ask the class to write a note into their books (activity 1.6) describing in their own words what happened.

As the pupils are writing this go from group to group checking with a sample of them that they have achieved objectives 1 - 3.

For classes who carry out activity 1.7 check the pupils' graphs as they draw them and then check their understanding

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by asking questions such as "If the boy pulls the rubber back to 3 cms, how far will the pellet travel". "If the pellet travels 7 ms how far do you think the boy pulled the rubber back?

Table

Distance Rubber band pulled back	Distance Pellet Travelled
0 cm	0 m
1 cm	2 m
2 cm	4 m
4 cm	8 m
5 cm	9 m
6 cm	9 m

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Lesson Plan

Unit 11 — Topic 2

Form of Energy

Time

This Topic should take between 3 and 4 periods to cover depending on the ability of your class.

Objectives

At the end of the topic the pupils should :

(1) know and be able to explain in their own words that energy can exist in different forms.

(2) know and be able to explain in their own word that energy can be converted from one form into another.

(3) be able to give examples of energy conversions from;

- movement into heat (activity 2.1)
- chemical into movement (activity 2.2)
- movement into sound/heat (activity 2.3)
- movement into electrical (activity 2.4)
- chemical into heat/light(activity 2.5)

(4) Recall and be able to explain in their own words the definition of the Five types of energy given in 2.6.

(5) more able pupils should be able to identify the energy changes involved in a number of everyday occurances such as;

(i) a car moving along a road.

(ii) a man chopping down a tree.

(iii) a boy switching on a light bulb.

Equipment

Each pair of pupils or group will need a piece of card about 4 cm by 8 cm, a paper clip, a straw and a piece of wire about 4 - 6 cm long.

Each group will also need a pair of tongs, a gas burner and a piece of magnesium about 2 cm long.

You will need a flywheel, an ammeter (0 - 1 amp), a dynamo and a belt or spring to connect the dynamo to the flywheel.

Suggested Lesson Format

Introduction

Discuss with the pupil the work they did in Topic 1. Ask the pupils to describe what they did in activity

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(1.2) bouncing ball and what they learned for this. Then ask them to describe what happened in the catapult experiment (activity 1.4/1.5).

Again ask them to explain what they learned from the activity. Ask the pupils to describe the type of energy that the ball and the pellet had. Was it electrical energy? Chemical energy? How would they describe it? Encourage the pupils to describe it as movement energy. (Some more able pupils might call it kinetic energy.) We use the word 'movement' because we feel it will mean more to the pupils but if any pupil knows and understands the term kinetic energy you may prefer to let them use it.

Activity

Ask the pupils if they can think of any different forms of energy beside movement energy. Then suggest that we use some movement energy and change it into another form. Let them carry out activity 2.1. And ask the children what happens. In the discussion emphasize that movement energy has been 'converted' or changed into a different form of energy - heat energy. Let the pupils carry out activity 2.2 and then describe what happens. Ask them where the movement energy of your breath comes from and discuss it so that they get the idea that the energy comes from the 'chemical' energy your body obtains from food. Do the same thing with activity 2.3.

Chemical --- movement --- heat + sound.

Because of the shortage of equipment you will probably need to do activity 2.4 as a 'demonstration' experiment. Get the technician to show the pupils how to set up the apparatus and then ask individual students "to see how much electricity" they can make by turning the flywheel.

Chemical --- movement --- electrical

Let the pupils work in pairs (or groups) for activity 2.5. Warn them not to stare at the magnesium flame and that it will be very hot. Demonstrate - without lighting the magnesium - what you want them to do and then allow the pupils to carry out the activity.

Discussion and Evaluation

Ask the pupils to explain in their own words what happened when they set the magnesium alight in terms of the energy and energy changes involved.

Chemical --- Heat + Light

Write key words for the pupils explanations on the board and then ask the pupils to write 4 to 5 lines in their books describing what they did and what happened.

Before letting the pupils read section 2.6 ask them if they can explain what we mean by "heat" energy, "movement" energy etc. As they describe them, write the description on the board and when you have discussed all five, then ask them to check if their description agree with those in their books.

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With more pupils you should have time to discuss the energy changes involved in everyday occurances such as these given in objective (5). Ask the pupils to discuss each occurance with their group and then ask an individual to report on what the group say.

Finally check that the pupils have achieved the objectives set for the Topic for instance by asking individuals to give you an example of an energy conversion from movement into heat or from chemical into light and heat.

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Lesson Plan

Unit 11

Topic 3
+
Summary 1

Sources of energy

Time

We suggest that you allow 4 to 5 periods to cover the Topic. The summary sheet is suitable only for more able pupils.

Objectives

At the end of the Topic and summary pupils should:

(1) know that the sun, food and some chemicals are sources energy.

(2) know that we can store energy either as chemical energy or as other forms of potential energy.

(3) the pupils should be able to recall and explain in their own words at <u>least four</u> examples of the use of stored energy in Seychelles.

(4) more able pupils should be able to explain in their own words that when we release chemical energy from a source we change the chemical that that the source is made of.

Equipment

Each group will need:

- a balloon with some string (3.1)
- a ruler, a pencil and a small "object" such as a rubber (3.2
- a magnet and a drawing pin or a pin (3.4)
- a magnifying glass and a small piece of paper (3.5)
- a gas-jar spoon. (or metal spatula), a gas burner and some samples of food such as cocconut, sugar or rice (3.6)
- a spatula and test-tube, with about half a spatula of sodium bicarbonate and half a spatula of citric acid, a supply of water (3.7)

Suggested Lesson Format

Introduction

Introduce the lesson by getting the pupils to blow up their balloons, tie them and leave them to one side. You may need to show them what you want done. When the pupils have done this ask them to name the different forms of energy that they used in Topic 2 and to explain how they changed energy from one form to another eg. movement to heat.

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Activity

Tell the children that in the next activity they are going to look at another form of energy. Ask them to read section 3.2. Then ask different individuals to explain and denonstrate to the class what they are going to do. Ask the rest of the class to watch and say if they are correct.

When you are satified that the class understand the instruction allow them to carry out the activity. As the pupils carry out the activity, move around from group to group asking the pupils to explain why the "rubber" moved more the second time.

As eacg group finishes, allow them to read and discuss with you and then carry out activity 3.3. After they have carried it out ask each group to discuss the activity amongst themselves so that they can explain it to you. Again visitthe group Do the same thing for 3.4, 3.5, 3.6 and 3.7. (Make sure the children realise that the energy to move the pin in 3.4 comes from their hand moving - and nor from the magnet).

Evaluation and Discussion

Go through the activities one by one with the whole class, asking the different groups to report their observations and explanations. Pick the pupils own key words for each activity on the board. Then ask the pupils to write out in their own word what they did, what happened and why they think it happened for each of the six activities. Allow the pupils plenty of time to do this. Judge the amount of writing you require by the ability level of the pupils. Go from pupil to pupil checking their work and their understanding of the objectives.

With the whole class discuss how we store energy in Seychelles. Discuss example of stored-chemical energy such as petrol, gas, kerosine, charcoal, batteries and food.

With more able pupils you should ask the pupils to distinguish between chemical and other forms of stored energy. Use their experience of activities 3.6 and 3.7 (chemical) and 3.2 and 3.3 (non-chemical) and show that in the first two the energy source was changed as the energy was released, in the second two it wasn't changed. Use this and summary sheet 1 to introduce the idea of chemical energy - objective (4).

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Lesson Plan

Unit 11 Topic 4

Storing Energy

Time

We suggest that you allow 3 - 4 periods for Topic 4.

Objectives

At the end of the Topic the pupils should:

(1) know and be able to explain in their own words that our bodies get the energy to move from the chemical energy released from the food we eat.

(2) we depend on plants to make our food.

(3) plants need sunlight to make food.

(4) plants take a long time to grow, especially trees which will take many years to grow.

The pupils should also be able to

(6) estimate the age of a tree or branch by counting the number of annual growth rings.

(7) explain in their own words why we need to plant and conserve trees in Seychelles.

Equipment

Each group of pupils will need:

4.1 - a ruler, elastic band and pencil.
4.2 - a stone, book or weight.

You will also need one or two sections of a tree branch or trunk showing the growth rings. If you can't get some yourself, you may be able to borrow them from the Science Centre.

Suggested Lesson Format

Introduction

Discuss with the class the activities they carried out in their last lesson. Revise with them the ways we use energy in Seychelles. Then tell them that today they are going to make some <u>stored</u> energy.

Activity

Ask the pupils to read 4.1. Then ask one or two individuals to describe what they are going to do and allow the rest of the class to 'judge' if they are right. When you are satify, the class understand, let each group begin. Both you and the technician should move around from group to group. Let each group tell you what they have done and then write up the activity in their book. As each group finishes this, let them read and then carry out activity 4.2. Again let them

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discuss and then report their results to you or to the technician.

When all the groups have completed the two activities discuss with them how they stored the energy in each case - and where the energy to move the pencil, stone came from. Get them to point out that in order to move their hand they had to release the chemical energy of food. Ask individuals to list off the food that they have eaten today and make the point that all the food we eat comes from the plants - even if it comes by way of other animals.

By the end of the discussion the pupils should be clear that for us to move our bodies we release chemical energy from food and we depend on plants to make all of our food.

Before you reach section 4.5 ask the pupils to "find out" from friends or from their parents how long it takes to grow each of the crops in 4.5. It's not necessary that the pupils should learn exactly how many days, weeks or months each crop takes. We simply want them to realise that plants take a long time to grow (objective4).

Show the pupils the cross-sections of wood that you have. Explain to them that trees grow different types of cell during different seasons of the year, so that a year's growth for a tree is made up of one dark ring of cells and one light ring. Let the pupils look at the cross-sections and work out how old they are by counting either the number of light or dark rings.

Let the pupils draw a cross-section of a six-year old tree branch. They can check their drawing with the photograph on the back cover of their unit.

Evaluation and Discussion

If possible, at this stage you should take the pupils outside the classroom to look at some trees growing near to the school. Ask them how old they think these trees are. Then ask how long do they think it would take to cut down. Dwell on the point that it may take 50 years or more to grow a tree but less than an hour to cut it down. Ask the pupils to name some things we use that are made of wood. Emphasise the importance of wood for our everyday lives and the need to both conserve our trees and to plant new trees to replace those we cut down.

Back in the classroom ask the pupils to write a note in their own words on why it is important to plant and conserve forests in Seychelles. If need be you should write a few key words on the board for them.

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Lesson Plan

Unit 11 — Topic 5

The cost of Energy

Time — We suggest that you allow three to four periods for this topic.

Objectives — At the end of the Topic the pupils should:

(1) be able to read an electricity meter correctly.

(2) given the readings of a meter at the start and end of a month be able to calculate the number of units of electricity used in a month.

(3) given the cost of a unit of electricity and the number of units used, be able to calculate the cost of a given number of electrical units.

(4) know that we measure the power of an electrical appliance in Watts.

(5) know that the greater the number of Watts (wattage) of an appliance the more electricity it uses.

(6) more able pupils should given the wattage of an appliance, be able to calculate, to the nearest hour, how many hours the appliance will take to use one unit of electricity.

Equipment — We feel that it is very important for this Topic that all pupils should have an opportunity to look at and read an electricity meter - during class.

Suggested Lesson Format

Introduction — Bring the pupils to somewhere in the school where there is an electricity meter in use. Show the pupils the meter and ask them to explain what it is and what it does.

Show the pupils how to "read the meter" and allow a number of them to take the reading.

Activity — Back in the classroom get the children to look at the photograph of the meter in their books, read it and write down the reading in their books without telling anyone else. You and the technician should check that everyone has read the meter correctly.

Confirm to the class what the reading is and say since we are using electricity in the school, then if we read

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the meter again this afternoon or tomorrow we would expect the number of units used to be more.

Ask them how many units would we have used during the day if the next reading was 23398? Check that all of the pupils understand. Explain the example in 5.1 and then ask them to do the first calculation. Check their understanding and explain if necessary on the board. Repeat this for the second calculation.

Before beginning section 5.2 discuss with the pupils how much they pay for electricity at home. Let as many pupils as can report on their electricity bill and then on the electricity appliances they use. If it is possible from the discussion, make the point that the more electricity/ appliances used the higher the bill.

Ask the pupils how much it would cost to use an electric iron for an hour. (about 60 cts). At this point we only want the pupils to have some idea of actual running costs. Now explain the cost of electrical unit in Seychelles (5.2) When you feel that the pupils understand, get them to do the first calculation (5.3) and check from pupil to pupil for their answers. Repeat for the second calculation.

Ask the pupils to read 5.4. Allow them a few minutes to discuss with their group how we could find out the answers to questions one and two and what appliances they think are using most of the energy.

Let one person from each group report on the groups suggestions, with Teacher for their answer to (3).

Again ask the groups to read, discuss and report on 5.5.

Evaluation and Discussion

Much of the discussion and evaluation for this Topic has been incorporated into the lessons. We suggest, however, that before you complete the Topic you checked the pupils understanding of the objectives by, for example, asking them to read a drawing of a meter at the start and end of the week and then by calculating the cost of the electricity used.

Explain to the pupils that the more power an electrical appliance has the more electricity it uses. Ask them which do they think would use more electricity in an hour an electric fan or an electric cooker? Tell them that we measure the power of an appliance in Watts. The higher the Watts or wattage of an appliance the more electrical power it will use. With more able pupils you should explain that an appliance with 1000 Watts will use 1 unit of electricity in an hour. Ask the pupils read 5.6 and 5.7 and then to do the calculations in 5.7.

Move around from group to group explaining and helping with the calculations where needed.

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Lesson Plan

Unit 11 Topic 6

Using Electricity Safely

Time

We suggest you allow four periods for this Topic.

Objectives

At the end of the Topic the pupils should:

(1) be able to wire a three-pin plug correctly.

(2) know that a 3 pin plug has 3 terminals, the Live, the Neutral and the Earth and that the Earth terminal is a safety device which must always be connected to appliances with 3 wires.

(3) know that the fuse is a safety device.

(4) know that a plug should not be used without a fuse.

(5) be able to explain in their own words that the fuse protects the appliance. If a large current which might damage the appliance comes through the circuit the fuse should break before the appliance is damaged.

(6) that a fuse must be chosen to suit the current the appliance will use.

(7) given the current used by an appliance in a circuit, be able to select a fuse of the correct rating from a set of three fuses of different ratings.

Equipment

Each group of pupils will need a screwdriver, a 13 amp three-pin plug which is connected to an appliance.

For 6,5 you will need 2 - 3,12 volt bulbs (Ray-box bulbs) connecting wires with crocodile clips, some steel wool and a labpack.

You can arrange to borrow a labpack from the Science Centre or from another school, or you can use up to twelve, 1.5 volt batteries connected in series.

Suggested Lesson Format

Introduction

Ask the pupils to name the electrical appliances they use at home. As they call them out write down the names of the different appliances on the board. When you have a list of about 10 ask the pupils to point out those which get their electrical energy from batteries and those which get their energy from the mains. Give a brief explanation that mains electricity has a much

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higher voltage than the electricity we use from batteries and so is much more dangerous.

Activity

Ask the pupils to read section 6.1, 6.2 and 6.3. Show each group the plug they are to open and let them begin. You and the technician should move from group to group watching and helping if needed. Make sure that <u>every</u> plug is checked before the cover is replaced.

As you go from group to group get the pupils to identify the three wires and where each wire should go. Discuss with them the need for the 'third' (Earth) wire. The full explanation of the need for the earth wire will be too difficult for most of the pupils, but make sure they can achieve objective(2).

For more able pupils try and get them to see that appliances with a metal casing - such as irons, kettles and fridges must always have an earth wire.

As each group finishes 6.3, let them go on to try 6.4. Ask them to discuss amongst themselves what the fuse is for.

Because of the limited number of labpacks available you will need to demonstrate activities 6.5, 6.6 and 6.7. But allow the pupils to make the fuses, each group should prepare one. The first should be only one strand of steel wool. From the activities we want the pupils to learn that a large current will damage or break the appliance, so if possible choose an old 12 volt bulb, one which is likely to 'blow' if 15 volts or more are passed through.

Evaluation and Discussion

Ask the pupils to describe what they observed. Try to lead them towards explain objective(5). Discuss attaining the dangers of not having a fuse for an appliance. Point out that without the fuse the appliance may break and the damaged or broken wires may cause a fire.

Also discuss the dangers of using too strong a fuse with an appliance - in that it will not protect the appliance. Point out to the pupils the need to choose a fuse to suit the appliance. Use the table in 6.9 to illustrate this. For example, by asking what would happen if you used a 2A fuse with an electric cooker or what could happen if you used a 13A fuse with a fridge.

Ask the pupils to copy the table into their books and write down in a fourth column what fuse they would choose.

Move from pupil to pupil checking on their work.

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Lesson Plan

Unit 11 — Topic 7

Cheaper Energy

Time

You should allow 3 to 4 periods for Topic 7. Only the more able pupils may have time to try section 7.5.

Objectives

At the end of the lesson the pupils should:

(1) know that we can obtain and use energy directly from the sun and the wind.

(2) recall one example each of how we can use solar and wind energy in Seychelles.

(3) Design and carry out an experiment to investigate which shape of sail is best for use with a model boat.

Equipment

Each group of pupils will need:

7.1 a test-tube, a hand lens, a thermometer and about 2 ml of water.

7.2 a metal tin-lid and about 20 ml of sea water,

7.4 a model boat (ask the technician to prepare small flat wooden boats from light wood about 10 cm long by 6 cm wide), cardboard, a nail and scissors.

It is very <u>important</u> that you check out well beforehand that the boats do not overturn when the sails are added. You may need to use smaller sails or add weights such as drawing pins to the keel. But test the boat beforehand - yourself.

7.5 For this activity you should have a photograph of a windmill.

Suggested Lesson Format

Introduction

Ask the pupils where does the mains electricity we use in our homes and in the school come from. Allow them to explain where the power station is and how the electricity "gets to" the school. Show them the transmission wires leading into the school.

Ask the pupils to explain what "they use" in the power station to make electricity - what type of stored

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energy do they use. Discuss oil and the cost of importing it into Seychelles and then ask the pupils if there are any alternative sources of energy we can use in Seychelles.

Activity

Allow the pupils 5 to 10 minutes to discuss other energy sources such as wood and charcoal - but remind them of the time needed to renew the trees.

Point out that "we have plenty of sunlight - lets see if we can use that."

Get the pupils to read 7.1 discuss what they are going to do and how they will find out if the water is getting hotter. Then let them carry out the activity and write up a note in their own words. Discuss with the pupils ways we could use solar energy in Seychelles.

Explain the idea of using sunlight to evaporate sea-water. Let the pupils set up activity 7.2. Ask them can they suggest any difficulty with using this technique on a large scale. Walk/the salt beds Project at Des Roches Island . There are also salt beds on Praslin - but they are no longer in use.

/about

One source of energy that we often use in Seychelles is wind power. Ask the pupils if they can think of how we use the winds' energy. Get them to read 7.4 and then in their group to plan how they will carry out the experiment. Move from group to group and get them to "explain their plan." As each group produces a satisfactory procedure let them begin the activity.

Discussion and Evaluation

Ask each group to discuss amongst themselves and then report to you on:

What they did
What results they get
What conclusions they made.

Having discussed these with you the pupils should then writeup a note about the experiment in their own words.

With more able pupils you may have time to show the photograph of the windmill and to discuss how the winds energy may be used to either pump water, make electricity or make flour.

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SEYCHELLES INTEGRATED SCIENCE

Unit 11

CONSERVING OUR ENERGY

SE045070

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THE MINISTRY OF EDUCATION AND INFORMATION

R E P U B L I C O F S E Y C H E L L E S

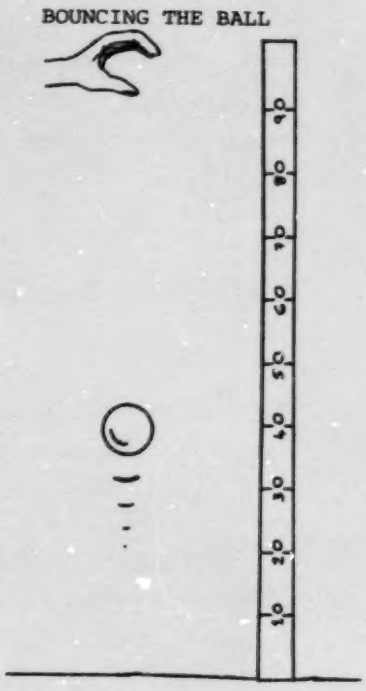
ABOUT ENERGY

1.0 We often use the word energy. Write a few words in your book to say what you think energy means.

Now we shall do some experiments to help us to find out more about energy.

1.1 Hold a ball exactly 1 m above the ground. Let it fall. (Do not throw it down). Use a ruler to measure how high it bounces.

Describe what happens in your book.

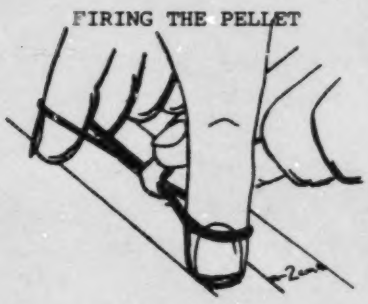


1.2 Make the same ball bounce higher, starting from 1 m above the ground. Describe in your book what you did to make it bounce higher.

1.3 Now make it bounce as high as you can. Estimate its maximum height - the highest you could make it rise.

Write down in your book how you estimated this height. Suggest a reason why you cannot make it bounce higher.

1.4 Mark three lines on the ground, so that each is 2 cm from the next. Make a small pellet with waste paper. Put a thin elastic band over your thumb and first finger, and place them on the first line.



1.5 Pull the elastic band back to the 2 cm line with the pellet. Let go. Measure how far your pellet has gone.

Now repeat this using the same pellet, but pull the elastic band back to the 4 cm line instead.

1 6 Did the pellet go further when you repeated the experiment ? Write a few lines in your book to describe and explain what happened.

1.7 Estimate how far you could make your pellet go. Your teacher may allow you to test this outside. Suggest a reason why you cannot make it go any further than this.

THROW ALL YOUR PELLETS IN THE DUSTBIN WHEN YOU FINISH.

FORMS OF ENERGY

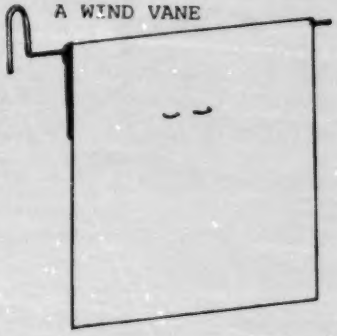
2.0 When you wrote your answers in Topic 1, you probably used the word energy. Look again at the experiments; you gave the ball and the pellet energy to move. We say that movement is one form of energy.
Let us find out more about forms of energy.

2.1 Rub your hands together fast for 15 seconds. When you have finished, describe what you felt and try to write a name for the form of energy that you felt.

RUBBING HANDS

2.2 Make a small wind vane using a piece of card, about 4 cm by 8 cm. Bend over 2 cm from one end of the card and staple it down. Bend a paper clip to make at least 4 cm of straight wire. Hang the card on the wire.

A WIND VANE



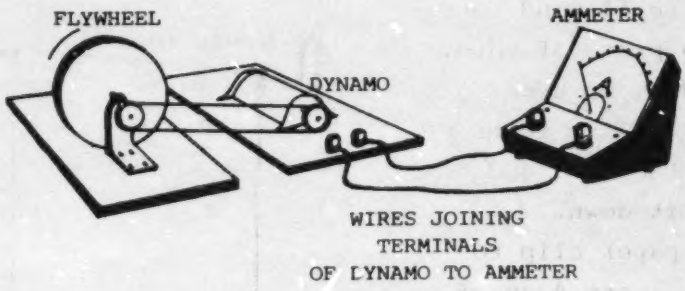
Use a straw to blow a gentle wind at the base of the card. Slowly, make your "wind" stronger until you are blowing as hard as you can.

Write a few lines in your book to describe what happened as you blew harder.

2.3 Clap your hands together as hard as you can ten times. Write down names for the forms of energy that your hands produce.

Write down some other ways in which you can produce these forms of energy.

2.4 Join the flywheel to the dynamo with a belt or spring. Connect the ammeter to the terminals of the dynamo.

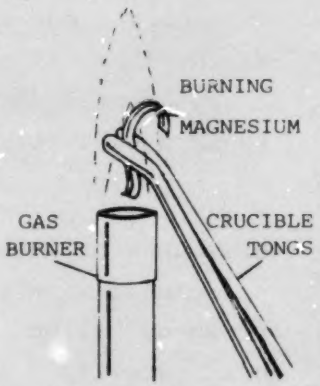


Slowly turn the flywheel with your hand. Watch the ammeter. Now turn the wheel faster until you are turning it as fast as you can.

Write a few lines in your book to describe what happened. Try to think of a name for the form of energy that you have produced in the ammeter.

2.5 Hold a small piece of magnesium metal with a pair of tongs. Put it in the flame of a gas burner for a few seconds.

Write a few lines in your book to describe what happened and write a name for the form of energy that you saw coming from the magnesium.



2.6 You have learnt that there are many forms of energy. The name we give to each form of energy depends on what is happening at the time.

You will have written your own names for different forms of energy. Compare them with the names that other pupils have written.

In general we use the names

HEAT ENERGY - when the temperature changes.

MOVEMENT ENERGY - when there is movement.

SOUND ENERGY - when there is a noise we can hear.

LIGHT ENERGY - when there is a light we can see.

ELECTRICAL ENERGY - when there is an electric current passing.

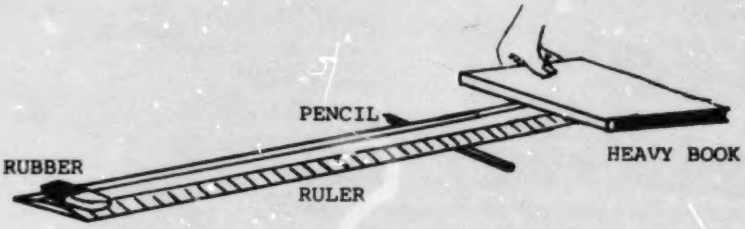
2.7 We can use all of these forms of energy in the right place and at the right time. Write down some examples of how and when we can use each one.

SOURCES OF ENERGY

3.0 In topics 1 and 2 you learnt about energy and some of the forms of energy that we use. We must also learn about SOURCES of energy - where we can get these useful forms of energy when we need them.

3.1 Blow up a balloon. Hold the neck tightly closed and tie it with a piece of string. Leave the blown-up balloon on your desk while you do the next experiment (3.2)

3.2 Make a simple catapult; put your pencil on the table. Place your ruler across it so that the pencil is 5 cm from one end of the ruler. Put a rubber, or another small object, at the end of the ruler further from the pencil:

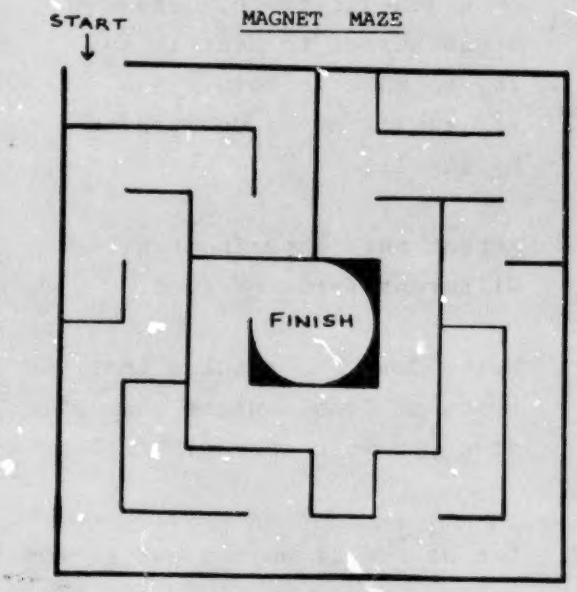


Drop a heavy book from about 2 cm above the end of the ruler near to the pencil. Look at what happens. Replace the rubber at the far end of the ruler. Repeat the experiment, but this time drop the book from about 10 cm above the ruler.

Describe in your own words what happened each time. Explain <u>why</u> the rubber moved more the second time, and where it got the energy to move from.

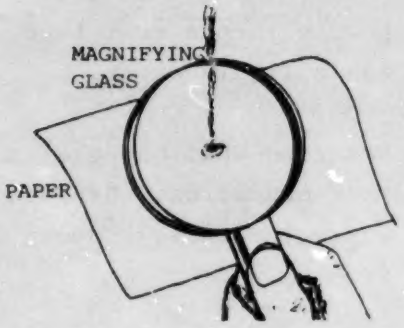
3.3 Now look again at your balloon. Hold the neck closed with your fingers while you untie the string. Let go. Describe what happens when you let go of the balloon in your own words. Explain where the balloon got the energy to move.

3.4 Use a magnet under this page to guide a pin around the "magnet maze". When you have finished, write down where the pin got the energy to move.



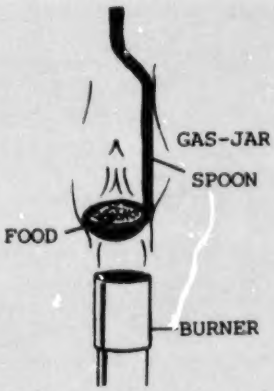
3.5 Use a magnifying glass to focus sunlight to a point on a piece of paper.

Describe what happens to the paper. Explain where the energy comes from.



3.6 You have been using a lot of energy to do your experiments. Let us see where you get your energy from:

Put a small piece of food on a gas-jar spoon. Use a gas burner to heat it and try to make it burn. See if it will continue burning by itself.

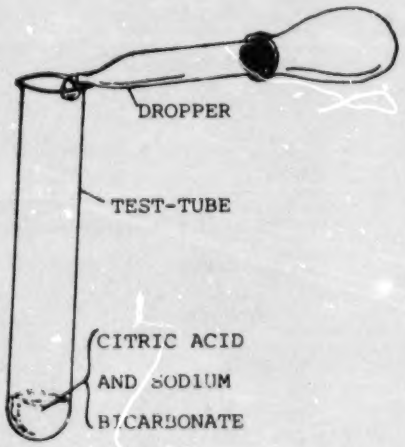


Repeat this experiment with different types of food.

Write down the results that you get with different types of food. Write down which of these foods can give you more energy. Explain why you say so.

3.7 Let us see if we can get energy from other chemicals:

Put some sodium bicarbonate powder and citric acid powder into a test-tube. Add a little water.



Describe what happens in your own words. Explain where the energy comes from.

(We use sodium bicarbonate to make cakes; citric acid comes from lemons.)

UNIT 11

SUMMARY 1

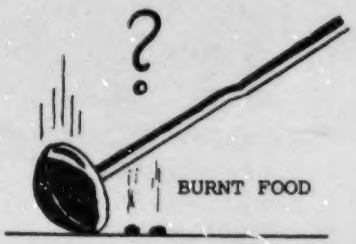
SOURCES OF ENERGY

The sources of energy that we have just studied all STORE energy inside them. That means they have the POTENTIAL to liberate or release energy - we say they have POTENTIAL energy.

Sometimes when we release energy from a source, we change the chemical that the source is made of:

eg When you burnt the food, what was left ?

You changed the chemical that the food was made of. The food stored energy as CHEMICAL energy.



Sometimes when we release energy we do not change the chemical that the source is made of.

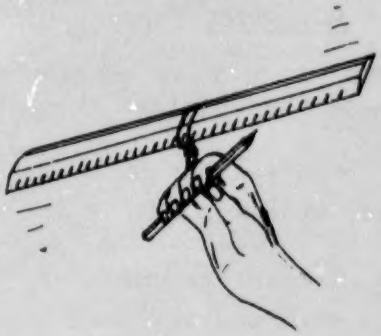
eg The balloon was made of rubber. When you blew it up, did you change the rubber into another chemical ?

Look back at the experiments you did; how was the energy stored in - the ball (1.1); the elastic band (1.4)
the flywheel (2.4); magnesium (2.5)

STORING ENERGY

4.0 We have learnt that we can change stored energy into useful forms of energy. Now we shall try to find out how to store energy.

4.1 Try to make a fan using your ruler, an elastic band and a pencil. Use the pencil to wind up the elastic band. Then let your ruler spin to fan air at you.



Describe in your book which forms of energy you used to make your fan. Suggest ways of improving it so that it works better.

4.2 Store some potential energy in a large stone or a heavy weight - lift it over your head and hold it there.

When you are tired, put it down carefully. Describe which forms of energy you had to use to store the potential energy in the weight.

4.3 We have learnt that when we move things with our bodies we use chemical energy. We get chemical energy from the food that we eat. We depend on plants for food. Plants use energy from sunlight to make their food (to photosynthesise).

4.4 All plants take a long time to grow. Find out and write down how long these crops take to grow: (from planting time until the crop is ready) -

banana; sweet potato; egg plant; okra(lalo); tomato; lemon; chinese cabbage; cassava.

4.5 Try to find a tree branch or a tree trunk which someone has just cut. You can find out how old the branch (or the tree) was by counting the rings. Each ring takes one year to make.

(You can also see the rings on wooden furniture, but it is not very easy to count them.)

Draw a picture in your book of a tree branch that is cut when it is six years old.

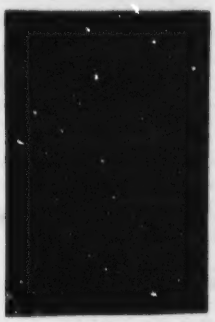
4.6 This unit is about CONSERVING OUR ENERGY - that means storing energy as well as using it. To help you to think about this, try to explain in your own words:

1) why we must plant food as well as eat it.
2) why we must plant trees as well as cut them down.

THE COST OF ENERGY

5.0 At the moment we use more energy than we replace. Every day, it is more difficult to find more new sources of energy (like oil). Looking for energy costs a lot of money. So, when we use energy, we have to pay for it.

5.1 Paying for electricity



Here is a picture of an electricity meter. It measures how many units of electricity we use.

Every month we have to pay for the number of units that we have used.

For example:

If the meter today reads:		22865 units
and the reading last month was:	-	22785 units
then this month we have used:	=	80 units

Calculate:

1) what the meter will read next month if we use the same number of units.
2) how many units we will use in a year if we use the same number of units each month.

THE COST OF ENERGY

5.2 If the first 50 units that we use cost Rs.1.26, and each extra unit that we use costs Rs.1.31, let us find out how much the 80 units will cost:

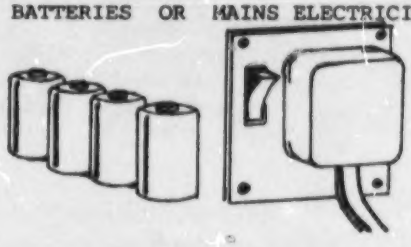
	UNITS	PRICE	COST
The first 50 units @ Rs.1.26 each:	50	x 1.26	= 63.00
The next 30 units @ Rs.1.31 each:	30	x 1.31	= 39.30
The whole 80 units together cost:			102.30

5.3 Now calculate the cost of (i) 100 units of electricity.
(ii) 150 units of electricity.

5.4 Look in your science laboratory to see if there is an electricity meter. Record the meter reading every week for a month. Then find out:
(1) how many units the lab uses in one month.
(2) how much this electricity costs.
(3) which appliances are using most of this energy.

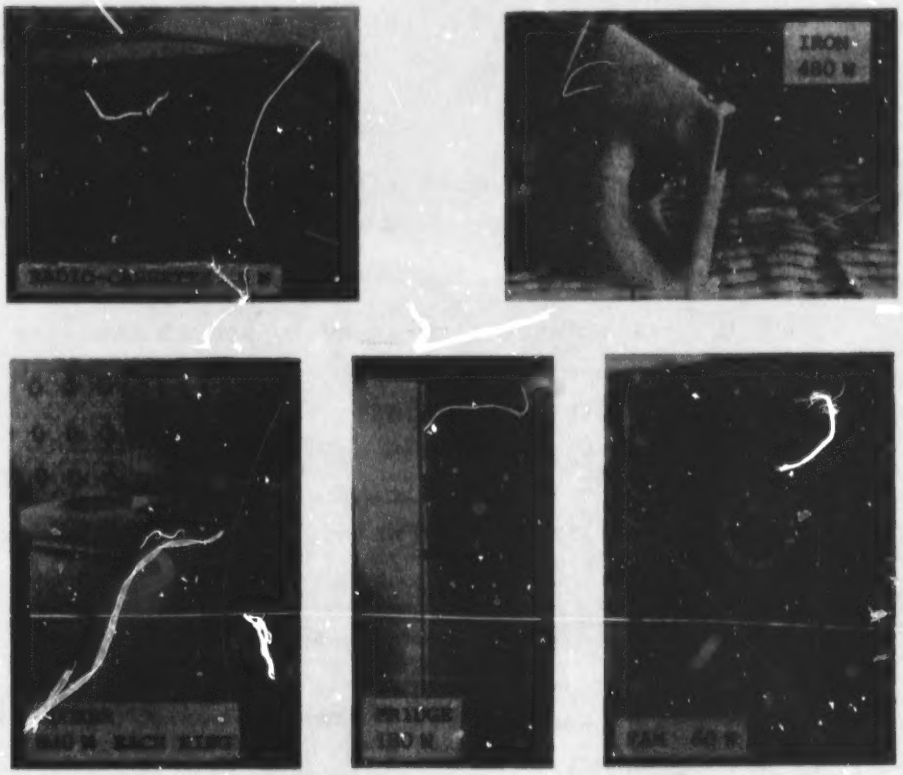
5.5 A small radio-cassette uses 1 unit in about 7 days (if you leave it on all the time). Would it be cheaper to use batteries ?

BATTERIES OR MAINS ELECTRICITY ?



Write down in your book how you would find out.

5.6 We measure the power of an electrical appliance in Watts (W). To find how much electrical energy an appliance uses, we multiply its power by the number of hours that we use it for; 1000 Watt.hours is the same as 1 unit of electrical energy.



5.7 Write down these appliances in a list. Start with the one that uses most power; end with the one that uses least power. Calculate how many hours it takes each appliance to use 1 unit of electrical energy.

UNIT 11

TOPIC 6

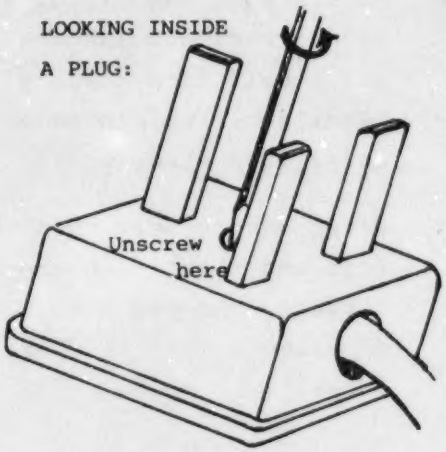
USING ELECTRICITY SAFELY

6.0 The electricity meter measures <u>mains electricity</u>, which comes from the power station. The voltage of mains electricity is 240 volts - much more than the 1.5 volts of a dry cell in a torch or radio. So, we must be very careful when we use the "mains".

6.1 <u>Looking at plugs</u>:

Use a screwdriver to take the back off a plug which you use in the lab. Draw a diagram in your book to show all the parts in it.

LOOKING INSIDE A PLUG:



Look for the terminals:

E = Earth
L = Live
N = Neutral

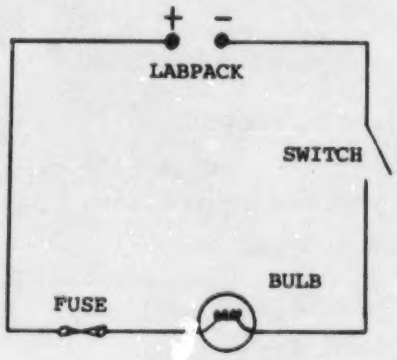
In your diagram, show the colour of the wire at each terminal.

6.2 Take out the <u>fuse</u> carefully. Which wire is it joined to ? Write down what is written on it in your book. Now put the fuse back in the plug.

6.3 Carefully unscrew the terminals where the wires are connected. Now give it to other pupils in your group to put the wires back properly.
LET THE TEACHER OR TECHNICIAN CHECK THAT YOU HAVE PUT BACK THE WIRES CORRECTLY.
Replace the back of the plug and make sure it works.

6.4 Now take off the back of the plug and take out the FUSE. Replace the back of the plug. Does it work without the fuse ? We shall now try to find out what the fuse is for.

6.5 We can make the circuit (right) using a labpack and a bulb from a car's headlight. We can make fuses from steel wool.



First make a very thin fuse and test it in the circuit. Repeat the experiment with thicker fuses.

6.6 Describe what happens as we turn the voltage up to 12 V, and then even higher than 12 V:

(i) with a thin fuse

(ii) with a thick fuse

6.7 Try to make the correct size of fuse for the circuit in 6.5. It should let the current pass when the voltage is 12 volts or less. It should burn and break when the voltage goes over 15 volts.

6.8 Try to write down in your own words why it is important to use a fuse in a plug. Also write down why we must always use the correct size of fuse.

6.9 We cannot use the same size of fuse with every type of appliance. The size of the fuse that we need depends on the amount of current that the appliance uses. Look at the table below:

APPLIANCE	POWER (WATTS)	CURRENT (A)
1 light bulb	60 W	0.25 A
2 light bulbs	120 W	0.50 A
4 light bulbs	240 W	1.00 A
Fridge	180 W	0.75 A
Iron	480 W	2.00 A
1 cooking ring	840 W	3.50 A
4 cooking rings	3360 W	14.00 A
4 rings & oven	4200 W	17.50 A
Radio-cassette	6 W	0.03 A
Fan	60 W	0.25 A

In a plug, we can use a 2A, 5A or a 13A fuse. Look at the table, then write down which fuse you would use for: a fridge; an iron; a fan; a radio-cassette

In each case, explain why you have chosen that fuse.

In the fuse box next to the electricity meter, we can use a 5A, 15A or a 30A fuse. Look at the table, then write down which fuse you would use for:

a cooker (with four rings and an oven)

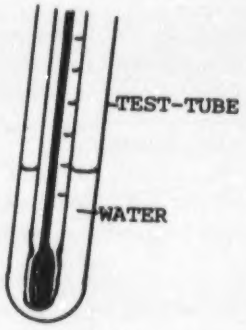
4 light bulbs

More to do: find out the power in Watts of some other appliances at school, at home or in shops.

CHEAPER ENERGY

7.0 In Seycheiles, we make electricity in the power stations in Victoria and Baie Ste Anne using oil. Oil is very expensive, and it will cost even more in the future. We must try to look for cheaper sources of energy.

7.1 We can do some jobs using solar energy from the sun. Put 2 ml of water into a test-tube. Use a hand lens to try and heat the water.



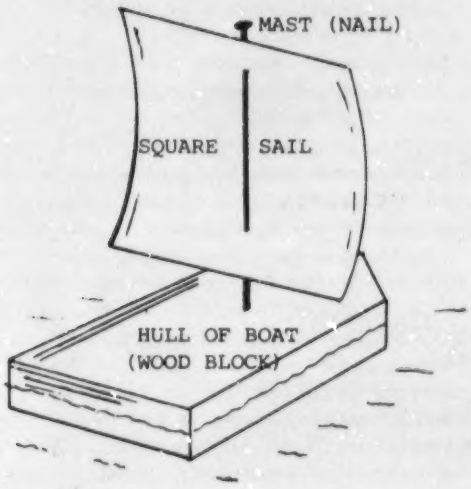
Describe in your book how you could find out if the water is getting hotter. How high can you make the temperature rise ?

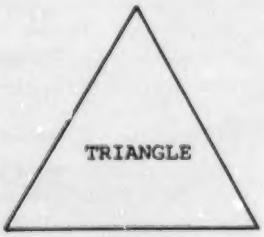
7.2 Try to make salt from seawater using only solar energy. Put some seawater into the lid of a metal tin in the sun. Record how long it takes to make salt.

Can you think of a way to make it faster ? How could we make our own salt in Seychelles ? Can you think of a way to make fresh water from sea-water using only solar energy ?

7.4 We can also use the power of the wind as a source of cheap energy. Make a sailing "boat" using a piece of wood, a nail for the mast and card for the sails.

Test some different shapes of sail to find out which carries the boat along best with the wind:





Write down and draw in your book how you found which sail was best. How can using sails on a boat help us to conserve energy ?

7.5 Find out what a <u>windmill</u> is. How can we get energy from a windmill ? Try to make a model windmill that will work on a windy day.

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